A2

Summary of Invention

Accordingly, it is an object of the present invention to provide a manufacturing method of semiconductor devices and a manufacturing apparatus of same, which can simplify the manufacturing process without raising the dielectric constant of an insulating film in a procedure of burying wirings using a damascene process.

According to another aspect of the invention the method involves making a first concavity in a first insulating film on a surface of a substrate and burying the first concavity covered with the barrier layer for the purpose of preventing the metal diffusion with wiring metal. The substrate is then polished to remove a part of the metal residing higher than the upper peripheral level of the first concavity so as to leave a first metal layer in the first concavity. A solution of an organic substance is applied tending to be bound to the metal layer onto the surface of the substrate so as to form protective film of the organic substance on the surface of the first metal layer for preventing metal diffusion. As second insulating film is formed on the surface of the substrate and the second insulating film is directly connected to the first insulating film. A second concavity is made in the second insulating film in a region above the first metal layer; and the second concavity covered with the barrier layer is buried by a second wiring metal layer to be connected to the first metal layer.

The protective film serves to prevent metals from diffusing from the first metal layer into the second insulating film upon the formation of the second insulating film on the first metal layer, and the procedure of forming the protection film is thus simplified since the protective film is formed by applying the solution onto the surface of the substrate. In addition to that, in an area where the first metal layer does not exist, or an

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area where there is no essential need of forming the protection film, the protective film is not formed. Thus, adverse effects of the protective film on the dielectric constant of the insulating film can be avoided. Furthermore, since the protective film can be simultaneously eliminated together with the second insulating film when it is etched away, the manufacturing process is thus simplified without the need for repeating a procedure of the etching twice.

A2 cont'd

According to yet another aspect of the invention, the organic substance is a triazole compound.

According to another aspect of the invention, the organic substance is selected from the group consisting of alicyclic alcohol compounds, saccharides, aromatic ring phenol compounds, aromatic ring carboxylic acid compounds, aliphatic carboxylic acid compounds and derivatives thereof, aminopolycarboxylic acid compounds, phosphoric acid compounds, alkanolamine compounds, aromatic ring amine compounds and aliphatic amine compounds.

According to another aspect of the invention, the method involves making a first concavity in a first insulating film on a surface of a substrate; burying the first concavity covered with the barrier layer for the purpose of preventing metal diffusion with wiring metal and polishing the substrate to remove a part of the metal residing higher than the upper peripheral level of the first concavity so as to leave a first metal layer in the first concavity. A solution of organic substance tending to be bound to the metal layer is applied onto the surface of the substrate so as to form on the surface of the first metal layer a protective film for preventing metal diffusion. The protective film comprises at least one of stannous chloride, stannous borofluoride, stannous sulfate, nickel sulfate,

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nickel chloride and nickel sulfaminate. A second insulating film is formed on the surface of the substrate and the second insulating film is directly connected to the first insulating film. A second concavity is formed in the second insulating film in a region above the first metal layer, and the second concavity covered with the barrier layer is buried with a second wiring metal layer to be connected to the first metal layer.

A2 cont'd

According to another aspect of the invention, the wiring metal is copper.

According to another aspect of the invention, the washing the polished substrate to remove the metal residing higher than the upper peripheral level of the first concavity is done so as to leave the first metal layer in the first concavity.

According to another aspect of the invention, a carry-in unit is provided where a substrate cassette receiving a substrate is carried in and the substrate has a metal layer formed in a concavities in a insulating film on the substrates. A first washing unit is also provided where a surface of the substrate is washed and a processing unit is provided where the solution of organic substance tending to be bound to the metal layer is applied onto the surface of the substance so as to form protection film on the surface of the metal layer for preventing metal diffusion. Also a carrying unit is provided where the substrate is unloaded from the substrate cassette carried in the carry-in unit, and carried among the units from one to another.

According to another aspect of the invention, the device further includes a second washing unit where the processed substrate in the processing unit is washed with a washing liquid and a drying unit where the substrate washed therein is dried.

According to another aspect of the invention, the first washing unit, the processing unit, the second washing unit, and the drying unit are arranged as a series

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